MALARIA, ITS PROPHYLAXIS AND TREATMENT.

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That malarial affections are on the increase, in certain localities, must be attributed to something more conclusive than to the mere improved methods by which it is distinguished from other allied affections. This increase became manifest long after the discovery of the plasmodium malariæ, which stamped its individuality, hence, indicating an absolute, and not relative increase. In suggesting tenable cause for this, the following factors, I believe, materially influence the conditions as they now exist. (1) Our more intimate intercourse with the tropics in general, and with our tropical possessions in particular. (2) The advent of the Spanish-American war. (3) The Panama Canal Operations. (4) The increased transportation facilities, dependent upon ever-progressive commerce. These we shall consider seriatim.

Our more intimate communication with the tropics is but the natural result of the economic law of demand and supply, and effect us only in so far as the increased number of vessels making port along our coasts, and infectible port towns, bring with them the anapholes, and passengers infected with the hemameba, through the agency of the mosquito, acting as the definitive host, and cause of blood parasite. Confirmatory of these remarks, I refer to reports by A. H. Doty[1], Health Officer of the port of New York; S. B. Grubbs[2], Past Assistant Surgeon U. S. P. H. & M.-H. H.: Juan Guiteras[3]; L. O. Howard[4]; H. R. Carter[5], and Walter Wyman[6]. While these reports are written more in reference to the stegomyia, and yellow fever, they serve to show what might be done in the case of the anapholes and malarial fever.

Craig[7] makes the following observation: "Of 1,267 soldiers ill of various diseases, and returning from the Philippines, found that 25 per cent. of them showed malarial parasites in their blood, unaccompanied by clinical symptoms of some other diseases. Randolph[8] points out that the increasing intercourse between the United States and foreign malarial-infected regions, especially by Government officials, may lead to increasing number of cases offering the characteristics of tropical malaria.

The advent of the Spanish-American war served to furnish us with many infected mediums, to complete the life-cycle in places where the anapholes abound. Forchheimer says, "In certain parts of this country, where anapholes exist, and malarial diseases had practically disappeared, the latter again became endemic upon the return home from the Spanish-American war of soldiers who had malaria. This accords with my own observation while mustering out hundreds of soldiers at the close of the Spanish-American war. Many of the soldiers showed distinct evidences of malarial infection, and failing to eradicate same no doubt started afresh endemics."

The Panama Canal operations have not only largely contributed to the mortuary statistics of the United States, but has, in no small way, been represented in infectible localities. However, by indefatigable energy and an exact knowledge of the requirements of the situation as they existed, the sanitarians so lowered the death rate of the canal zone as to challenge that of many of our progressive cities.

Increased transportation facilities furnish us with sanitary problems of a more personal nature, dealing, as it does, principally with our railroads, and water-crafts, plying in small streams.

Railroads not only transport infected people to infectible localities, but convey as well anapholes to unfected localities, giving rise to new foci of malarial infection. To convince one of the truth of this statement it is only necessary to watch the swarms of mosquitoes that enter coaches while stopping at some station located in the swamps. These mosquitoes are distributed along the entire railroad system.

One of the greatest contributors to mosquito-breeding places is to be found in the continuous ditches on each side of railroad beds. These ditches are always filled with stagnant water, and generously "stocked" with mosquitoes by freight and passenger trains. A correction of this insanitary oversight insisted upon by the Railroad Commissioners would go farther than anyother one measure towards the extermination of mosquitoes in certain inland towns, and should meet with the approval of all health officers.

The life-cycle of the mosquito being established, admits of absolute laws for prophylaxis, of which we shall treat directly, as it is not the purpose of this paper to deal with the habits and morphology of the parasite.

Prophylaxis can be conveniently summed up under the following heads: (1) Prophylactic measures directed towards the destruction of the mosquito and their larvæ: (2) Prevention of the parasite gaining entrance into the human body: (3) Increasing the resistance of the human body to the parasite. (Marchiafa and Bignami.)

It will be convenient to divide prophylaxis into that as relates to towns and premises. Sanitary problems presenting themselves along certain coasts, and in districts where swamps abound, shall be relegated to the engineering skill of the Government, State, and municipality. Through these departments many miles of boggy swamps have been reclaimed by suitable draining and "filling in." River banks have been trimmed so as to no longer hold overflow water, and their beds narrowed in order to increase the current. Small lakes and ponds, which for certain reasons cannot be drained by ditching, may be emptied by sinking deep wells in their bottoms. That this did not prove a success in our city (Montgomery) was due to wells becoming stopped with mud and trash. This could be obviated by covering openings to wells with croker-sacks. Such places that cannot be drained should be oiled. The oil not only inhibits larval life, but kills many female mosquitoes that light on the surface of the water for the purpose of depositing their eggs. The oil must be applied once in two or three weeks, and the grade known as "fuel oil" is well suited for the purpose.

It is at times not desirable to drain certain ponds, or pools, but in which mosquitoes breed abundantly. For this purpose Mr. W. P. Seal[9] of the Aquarium Supply Co., of Delair, N. J., recommends the top-minnow (fundalus notatus.) These minnows are very destructive to larva, and in sufficient numbers will keep the water free from "wigglers."

Prophylaxis of towns to be effectual must comprise the concerted action of sanitary department and individual citizens. Suitable ordinances should be directed towards the extermination of mosquitoes, which may be accomplished by destroying their breeding places. These will generally be found in such places as leaking hydrants, and "shut-offs," unused wells, and cisterns, various receptacles about the yards, notably among which we might mention vessels in chicken coops, watering troughs, barrels placed under gutters, and under-hanging gutters themselves, also trees with knot-holes in them. It is generally the fact of these trees with knot-holes in them holding water, that causes a shady town to be known as a malarial town.

Prophylaxis of premises includes that of outdoors and indoors. Indoor prophylaxis is to begin with suitable screening, meshes of screens not to exceed 1-18 or 1-16 of an inch. The 1-12 is too large to inhibit passage. Do not forget to stop openings to fire places, as mosquitoes may enter the house down the chimney.

The most effective way of killing the mosquito, when they are too numerous to be killed as individuals, as when seen resting on screens, walls, etc., is by fumigation. Sulphur and formaldehyde are the agents usually selected, however, pyrethrum is of some service—not being so penetrating, and the fumes not so lasting—but is open to the objection of not always killing the mosquito, but merely stunning them, and upon admitting fresh air into the room, all mosquitoes not gathered at the time may become resusciatated. "Culecide," which is a mixture of equal parts of gum camphor and crystal phenol brought into permanent solution by aid of gentle heat was extensively used in the yellow fever epidemic of 1897. The mixture is placed in a vessel with tall sides in order to prevent its coming in contact with the flame—as it is inflammable. Two ounces had better be used for each 1,000 cubic feet. Its lethal effect is about the same as that of pyrethrum with the disadvantage of being expensive, and not altogether devoid of danger.

The mosquitoes being destroyed, it is now necessary to prevent the hatching of eggs by emptying all vessels holding stagnant water. Those most likely to escape our attention being vases, cuspidors, bottles, jugs, unused traps to water closets, and especially vessels put under table legs and safes. As these latter are intended to hold water it is necessary to oil them.

Preventing malarial parasites gaining entrance into the human body is well-nigh impossible in certain localities. Success in preventing infection is in direct proportion to one's vigilance, and is influenced by environment. In a general way we might suggest a change of residence, in some instances merely from one part of a town to another, as the mosquito seldom makes long excursions. Remain indoors after dark; however, it must be borne in mind that *our brilliant electric lights might make some change in the nocturnal habits of the anapholes,* causing them to venture out in the daytime. It may become necessary to sleep under mosquito netting even though the house be screened, as it is not at all unlikely that a few stragglers will find their way in, and should they be "loaded," are infectious.

Many ill-savored lotions are placed on the market, which it is claimed prevent mosquito bites, and a cure for same should they bite notwithstanding. These lotions usually consist of certain essential oils, such as pennyroyal, citronel, and lavender, dissolved in alcohol. I do not believe they accomplish the end for which they are intended, as they only hold at bay the mosquito until the lotion evaporates, thereby merely delaying the assault for a time sufficient to procure sleep.

A piece of personal prophylaxis of great importance to the physician consists in avoiding the bites of mosquitoes found about the bedside of patients infected with malaria. The attending physician may succeed in preventing their bites on hand, face, neck, and head, should he be short of hair, but while his attention is directed to the patient, such mosquitoes as lurk under the bed—and this is a favorite place for the anapholes—viciously attack the ankles. I have at last learned the hard lesson of wearing, all the summer, high-top shoes.

Treatment.—As soon as malarial parasites are found in the blood, or as soon as a diagnosis of malarial fever has been made, the patient is to be put to bed, under mosquito netting, the same as in case of yellow fever, and required to remain there at night, at least throughout period of convalescence. This is a matter of importance, for not only may the mosquitoes become infected and convey the disease to others, but may reinfect the patient by having fed on his blood in previous weeks when same was filled with parasites.

If patient is seen at time of chill, much can be done for his comfort by administering spts. chloroform, or some hot diffusible stimulant, by the application of external heat, and with sinapisms prudently placed.

A mercurial purge, followed by some saline, is in most instances indicated. The doses of calomel as suggested by many authors are inadequate for this climate, therefore such doses as 1-8, 1-2, or 1 grain should not be prescribed, except in case of infants or young children, as they do not reach the liver. For remittent malarial fever larger doses of calomel are advised, say from 5 to 15 grains to be given in one, or divided, doses. I have seen a remittent malarial fever with a temperature only partially influenced, after repeated and full doses of quinine, and running a course strikingly like that of typhoid fever, make appreciable drops upon giving additional doses of calomel. This is a noticeable feature of accompanying charts, and seems to be a *sine qua non* in more speedily terminating the disease.

Quinine being the exact chemical limitant of the action of the causative parasite, is specific. Its action is most effective when sporulation has taken place into the plasma of the blood, therefore its maximum effect should be obtained at this time. If this is reckoned in the intermittent form of malarial fever, quite small doses of quinine are sufficient to rob a fever chart of much of its symmetry; however, in the remittent type of malaria larger doses are required, and the drug should be given at three-hour intervals throughout the twenty-four hours. Frequent causes of failure to cure the patient is due to the *omission of the drug at night.*

The dose of quinine to be prescribed depends upon the alkaloidal strength of the salt selected; upon the condition for which it is to be

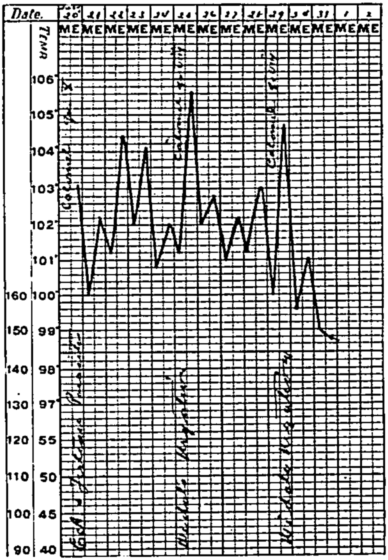

Figure 1.

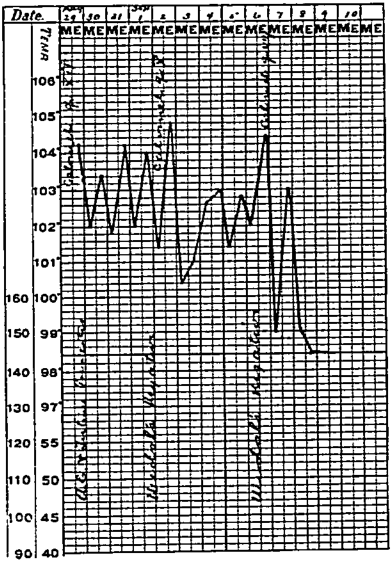

Figure 2.

used; and upon the method by which it is used. From experiments performed, based upon observations of fresh water amebas, it was predicted that the concentration of quinine of 1-5000 in the blood would inhibit ameboid movement of parasites and by estimating the total weight of the blood in the body the required amount of quinine could be foretold. The amount of blood in an individual weighing 130 lbs., was estimated to weigh 5,000 gms. (13.5 lbs.) The required amount of quinine, therefore, to make a blood dilution of 1-5000 would be 1gm. (15.5 grs.)

Hypodermic injections of quinine, I am sure, are not used as generally as their importance demand. Abscess formation has been a great obstacle to their use, and yet they need not occur, if technique is conformed to aseptic teachings, and the injections made deep into the muscle tissues. For these injections the compound salt of quinine hydrochloride and urea is convenient to use, as it is soluble in its own weight of water, and the irritation but slight. Laverans suggests the following formula as being very effective, and its injection painless. Rx. quin. hydrochlor. grs. viiss; antipyrine, grs. v; distilled water, m. xv. The ordinary hypodermic syringe is frequently too small for these injections, therefore, the antitoxine, or "Sub Q.," syringe may be used. Intravenous injections may most satisfactorily be made by introducing the point of the needle *directly into the vein*, which is to be made as prominent as possible by constriction from above. Bacelli suggests the following formula. Rx. quin. hydrochlor. grs. xv.; sodium chlor. grs. XII.; distilled water, drs. iiss. The solution to be given warmed. Hypodermoclyses when indicated, may also contain quinine in solution. Ten to fifteen grains of the hydrobromide, or hydrochloride, being generally used. Loss of tissue is not infrequent, especially if too much tension is caused. Enteroclyses have been suggested when quinine cannot be given by mouth, however, they should have no place in the treatment of malarial affections, as the hypodermic injections are much more satisfactory, and less objectional. The bowel soon becomes intolerant, therefore only in cases of amebic dysentery should quinine be exhibited by the bowels. Suppositories are restricted in their use for same reasons as that of enteroclyses. Some authors stating that none of the quinine is absorbed. Certain pediatrists have suggested that suppositories be used combined with a little opium and belladonna, and that the nurse be instructed to compress the buttocks for half an hour after the insertion of the suppository into the bowel. Innunctions have but few who are willing to acknowledge any effect of quinine exhibited according to this method, however, I fail to see why a soluble salt of quinine, when incorporated with lanolin and lard should be more impossible of absorption when rubbed into a thin skin of an infant or young child, than is mercury, the iodides, salicylate, chloral, etc. I bear willing testimony as to the efficacy of the following formula: Rx. Quin. hydrochlor. (or bisulfate), grs., xl.; lanolin and lard, of each oz. 1. If paroxysms of malarial fever were not cut short by this mode of administering quinine in certain infants, then these cases are striking instances of autotherapy, or of "post hoc ergo propter hoc." The fact that the amount of quinine absorbed is uncertain should be no bar to its use, for the same objection holds good for all inunctions.

Malarial cachexia may or may not, respond to quinine therapy, however, it is certain that the quinine should be extended over a longer period of time, and had better be combined with arsenic, iron, and strychnine. These patients, as a rule, make quicker recoveries when sent to an elevation of from 2,000 to 3,000 feet.

Hemaglobinuria, or black-water fever, has given occasion for a greater diversity of opinion, as to its cause and treatment than any other syndrome. T. W. Jackson[10] says: "I hesitate to do more than describe it." McCay[11] suggests that the hemolysis is due to injury of stroma of red blood cells by malarial parasites, also to the administration of sulfates. He suggests, in way of treatment, that only the hydrochloride of quinine be administered in regions where black-water fever is prevalent. Forchheimer[12] states: "When hemoglobinuria occurs in a patient with malarial parasites, without quinine having been given, quinine frequently cures both the malaria and hemoglobinuria. When the hemoglobinuria occurs after an attack of malaria, the parasites being absent, quinine should not be used, for it does no good and usually even does harm. If in a malarial attack the administration of quinine is followed by hemoglobinuria, *i. e.*, during the time of its maximal physiologic effect, the quinine should be withheld, as it seems to be shown that the drug is acting directly as proximal cause." My own observation has been that many of these cases develop without the intervention of quinine and disappear without the aid of quinine.

In the treatment of other diseases a possibility of the clinical course being modified by a concomitant sub-stratum of malaria, should always be borne in mind. The diseases most frequently associated with malaria are tonsilitis, bronchitis, pneumonia, typhoid fever[13], enterocolitis, and with chronic diarrhœa. I have seen patients with tuberculosis whose afternoon rise of fever was due to malaria instead of the tubercle bacilli. Skin affections are influenced by a concomitant malaria, as so often seen in case of erysipelas, psoriasis, impetigo, and urticaria. Many of the more trivial symptoms that harass mankind are chargeable to malaria, as headache, biliousness, general malaise, indigestion, cramps, myalgia, etc. It is also frequently responsible for neuralgia as supra-orbital, intercostal, sciatica, etc., and causes all manner of nervous manifestations ranging in severity from mere nervousness, to that of neurasthenia, hysteria, and dementia.

In reckoning pathology we are also to credit malaria with causing structural changes in the internal organs, such as is found in the kidneys, liver and spleen.

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